



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

GEOGRAPHICAL REVIEWS

ON UNDERGROUND WATER IN LIMESTONE REGIONS

E. A. MARTEL. *Nouveau traité des eaux souterraines*. 838 pp.; maps, diags., ills., bibliogr. Librairie Octave Doin, Paris, 1921. 10 x 7 inches.

Everyone who is familiar with the history of the exploration of caves knows the name of E. A. Martel. He is probably the most indefatigable and courageous student of speleology. For thirty-eight years, as he constantly reminds the reader, he has devoted a large part of his time to the detailed study of caves in many parts of the world. The Pyrenees, Central France, the Balkans, and the Juras have been his chief fields of study. In this book he has gathered together the best of his material and has arranged it in a systematic manner that greatly increases its usefulness. But he has included descriptions of almost innumerable caves, and there are many thousands of references to villages and town and streams whose names are spelled differently on different maps, and many of the names cannot be found in the gazetteers. Under these circumstances it is nothing short of deplorable that the publishers have not supplied an index.

The work of Martel has involved a quite remarkable collection of facts regarding underground conditions, and he knows the literature thoroughly. His detailed appendixes and bibliographies are virtually complete except for American references during the past ten or twelve years. Three hundred and eighty-two illustrations, more than half of them diagrams of caves and underground channels, furnish the reader with an unparalleled quantity of facts.

But it is on the side of facts alone that the book can be commended because of two very serious defects which it seems worth while to point out in order that students of his book may not be led astray. Though the title would lead one to suppose that the treatise dealt with underground waters in general, as a matter of fact it is chiefly a *treatise on underground water in limestone regions*, and it is in some respects unfortunate that this limitation of the title was not included in it. The treatment of underground waters in other than limestone regions is distinctly superficial. And it is so casual and incomplete that from reading it one might suppose that the land surface of the earth was almost everywhere underlain with limestone and that the normal occurrence of underground waters was in fissures and other openings in limestone at a considerable depth.

A careful reading of the book leads to the conclusion that the contents fall in four classes: (1) a setting forth of the author's controversies with other students, whether those controversies relate to ground water or not, (2) the author's method, which is to deny a rival explanation and assert one's own, or at the most to point to one's thirty-eight years of experience and let it go at that, (3) the best examples of caves with very clear sketches and detailed descriptions, and (4) a profound misconception of many physical theories of land-form origins and particularly of the limits that the authors of those theories themselves have recognized and set up. He goes into the question of ice erosion, reviews the several opposing opinions or theories on the subject in a quite superficial way, and then brands opposing views as "exaggerations of the theory of erosion by ice" (p. 439). After the greatest possible exaggeration of those physical processes that he has become most familiar with through a lifelong study of caves, he recognizes that there are a few other regions on which these processes may not be so important. In the face of this recognition he does not alter his exaggerated statements but permits them to stand, merely following them with curiously contradictory remarks of an opposite kind that appear to be merely anchors to windward. When he speaks of his own theories it is as if he were not discussing a theory, but truth; when he discusses opposing views he treats them as theories, forgetting that he himself starts with a fixed idea, for example, that practically all valleys are affected by fissures. Much controversy appears to be responsible for the introduction of an element of war psychology. Those who disagree with him have too closely followed the German method, which is to have preconceived theories; whereas the French method is that of Plutarch—to work from the facts and derive clear hypotheses "that reveal the true light"! The reader should not hastily conclude that in this matter he rails only at Germans. Frenchmen and Englishmen and Americans who differ from him are *all* classed as followers of the German method. Natur-

ally this leads him to a general denunciation of German scholarship and the Germans, those "pedantic protagonists of false hypotheses" (pp. 67, 147, 450. etc.). The author must take a grand fling at all of his old adversaries. His book on ground waters is his last great opportunity. Scouting the armchair scholar and the followers of "German methods" (including Lugeon, de Martonne, de Margerie, and Davis), he makes caves the central idea of his creed. He revives old hypotheses which many have forgotten or cites in vigorous terms facts that no one in the world denies.

Many men of straw are set up. He thinks the word *karsting* connotes Cretaceous rock, on the one hand, and a geographical locality, namely the Karst of the eastern Adriatic lands on the other, and he would therefore substitute the phrase "phénomènes du calcaire," (pp. 213 and 214). A few sections in the early part of the book are devoted to a condemnation of the idea of the fluvial cycle, but when we reach the evidence in support of his views we find that it wholly lacks vitality. Newberry, Dana, Powell, Gilbert, Dutton, and Davis of the "American school" have exaggerated the facts of the fluvial cycle because of their too limited knowledge of fields of rapid erosion, like that of the Colorado! Side by side with his condemnation of this state of affairs there is the recognition of the great importance of Mammoth Cave; and no one but Martel (according to himself) has recognized its real mode of formation, except possibly Shaler to a certain degree (p. 36)! There are strictures on the use of the word "cycle," and a general condemnation of Slichter's work on ground water, though in later pages he returns to Slichter for many a commendatory statement.

If he finds a steep-walled valley with a relatively straight course, the valley occupies a fissure. Because the trend of joint planes in the rock on gorge walls corresponds to that of the valley for a short section, that is sufficient proof that a joint or other crack controls the course of the river—and the implication is that it did so throughout its development (p. 47). Many other writers would not deny the influence of fissures in controlling the initial courses of valleys, and certainly no one would deny that influence in a limestone region; but he is thinking of the merest origins, and the general student thinks of all the successive changes in river curves in the fashioning of the valley wall, changes that are closely interlocked in their influence on the final result. In short, the author's view is everywhere narrow, and the student of land forms must take a much broader view. Martel finds U-valleys that have not experienced glaciation and V-valleys that have, and that to him is the very essence of proof of the incapacity of ice to erode! He does not stop to inquire what kind of a U-valley it is, nor does he illustrate the U-valley that he has in mind, nor does he say in what regions the U-valleys occur that have not been affected by ice. His method is that of the old-style logician, not that of the scientist. When he is observing and recording facts respecting caves he is truly scientific, but when he comes to their explanation he is absurd, and the climax of absurdity is the style of argument that he thinks successfully meets what he chooses to call opposing views and false theories. When he says that geological *leaders* have not visited caverns in sufficient numbers (pp. 56 and 57) one could reply in his fashion by saying that Martel had visited them too much.

Under a section headed "Hypnotisme du cycle d'évolution morphologique" he has a discussion principally of caves, with occasional denials and condemnations of phrases and theories respecting the origin of land forms, but later (p. 299) he accepts the conclusion of Cvijić, characterizing it as "une conclusion synthétique"; but Cvijić has developed the cycle idea, and in this number of the *Geographical Review* that idea is set forth in detail. Cvijić himself develops his idea as one *befitting karsted country*, and no one has ever said that there was no need to have developed the idea of the karst cycle! Just as the normal cycle is modified for glaciated regions or for desert regions, so it must be modified in the case of limestone regions, but this does not mean that the idea of the normal cycle must be abandoned. If we were to accept this line of argument Darwin's work becomes foolish, because it has been modified since the "Origin of Species" was published; and Agassiz was but a blundering amateur when he asserted on looking over the New England landscape that what he saw led him to think that if he had encountered those phenomena at any place in Switzerland he would say the ice had been there!

To Martel we owe a great debt for an intimate knowledge of many caves. To Penck and others we owe something for their development of the idea of the karst cycle. To Cvijić we owe most for the clear amplification of the idea of the cycle and its more rigid application to *the actual conditions of the field*, and particularly for his clear distinctions regarding the *three hydrographic zones in karsted countries*. But outside of these studies of karsted regions

there are great desert areas, and there are also great areas where limestone rock does not occur. And most of these, whether fissured or not, have experienced a quite different development of land forms than those that have been so constantly visited by Martel and have so impressed themselves upon his mind.

One has only unqualified admiration for Martel's courage in making underground explorations that few have dared to make. He has gathered original material from really dangerous sources. In his devoted quest for facts he has never allowed himself to be defeated by conditions, however perilous.

THE PHYSIOGRAPHY OF SHORE LINES

D. W. JOHNSON. *Shore Processes and Shoreline Development*. xvii and 584 pp.; maps, diagrs., ill., bibliogr., indexes. John Wiley & Sons, Inc., New York, 1919. \$5.00. 9 x 6 inches.

Major Johnson's book is a most noteworthy contribution to the science of physiography, presenting for the first time a full systematic discussion of shore-line development, a subject to which Gilbert, Davis, Gulliver, Jefferson, Abbe, and some others in our own country have made valuable contributions.

The opening chapter of the book treats of water waves, and presents to the reader a brief survey of the literature on the subject, "which may be useful in showing the growth of our knowledge of waves since the time of Leonardo da Vinci." Waves of oscillation, waves of translation, earthquake and explosive waves, and tidal waves all find adequate treatment; such features as wave motion, wave form, wave height, wave length, and wave velocity being carefully worked out. Some notion of the painstaking care bestowed upon the work may be gained when it is noted that the sources on which the author has drawn include nearly two hundred titles given under 168 numbered references at the close of the first chapter. The chapter on the work of waves discusses wave energy, the nature of wave attack, measurements of wave energy, the damage done by storm waves, conditions affecting wave energy, wave refraction, and depth of wave action. The chapters begin with an advance summary and close with a *résumé* followed by a full bibliography. The plan is admirable, and the author's following of it is thoroughly satisfactory.

The transportation of shore debris by many different kinds of currents receives adequate treatment in the author's consideration of the many different types of currents, as wave currents, tidal currents, wind currents, planetary currents, pressure currents, convection currents, salinity currents, and river currents, including also reaction currents, eddy currents, and hydraulic currents (the "polarization currents" of Cornish). This chapter must prove of especial interest to the geologist and the engineer. The harbor engineer is all too prone to believe that the forces operating on the shore line are among the forces of nature that "are subject to no calculation." Work of this kind, however, should make him hopeful that some coming generation may predict shore changes and plan harbor and coast defenses with an assurance wholly unknown today. The references at the close of this chapter present an interesting bibliography, indicating a wide interest in and extensive literature on this subject.

One chapter is devoted to the terminology and classification of shore lines, on which subject Gulliver, J. W. Gregory, Davis, Suess, von Richthofen, Penck, and others have published important papers. Professor Johnson distinguishes shore lines due to submergence from those due to emergence, and he finds that there are neutral shore lines and compound shore lines, where many students of the subject had regarded the shore line as subsiding or even undergoing elevation. This is especially true of his studies of our South Atlantic coast. The author uses the term "tombolo," adapted from the Italian and earlier used by Gulliver, for a connecting bar which ties an island to the mainland. As this word is not yet in common use, the writer of this review should like to see Ovid's word for just such a land-tied island in the Mediterranean or the French-Indian word that is used in the Wisconsin-Michigan district introduced into our literature.

The development of the shore profile is next considered, and the validity of the theory of a marine cycle is discussed. The author here points out that we may have marine peneplains, eolian peneplains, and peneplains due to glacial action, as well as those which are the result of rain and running water. The term "monadnock," which has been defined as "an erosion remnant left standing above a peneplain made by running water," may then be subdivided, and there may be monadnocks due to the incomplete reduction or the incomplete develop-